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Hence, the rate of the engine in miles per hour is

$$\frac{7\times 20\times 88\times \pi\times 3600}{100\times 3\times 5280}=28\pi \text{ miles.}$$

ALGEBRA.

123. Proposed by ELMER SCHUYLER, B. Sc., Professor of German and Mathematics, Boys' High School, Reading, Pa.

$\left(\frac{1+x}{1-x}\right)^{\frac{1}{4}}+\sqrt{\frac{1-a}{1+a}}\sqrt[4]{\frac{1-x}{1+x}}=2\sqrt[4]{\frac{1-a^2}{(1+a)^2}}$, and $\sqrt{a^2-x^2}+x\sqrt{a^2-1}=a^2\sqrt{1-x^2}$. [*Haddon.*]

Solution by JOHN A. VAN GROOS, Fellow of Mathematics, University of Oregon, Eugene; Ore.; R.L.MOORE, Student in University of Texas, 2206 San Marcos Street, Austin, Tex,; and G. B. M. ZERR, A. M., Ph.D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

(1). Multiply $\left(\frac{1+x}{1-x}\right)^{\frac{1}{4}}+\sqrt{\frac{1-a}{1+a}}\sqrt[4]{\frac{1-x}{1+x}}=2\sqrt[4]{\frac{1-a^2}{(1+a)^2}}=2\sqrt[4]{\frac{1-a}{1+a}}$ through by

$$\left(\frac{1+x}{1-x}\right)^{\frac{1}{4}}. \quad \therefore \left(\frac{1+x}{1-x}\right)^{\frac{1}{2}}-2\left(\frac{1-a}{1+a}\right)^{\frac{1}{4}}\left(\frac{1+x}{1-x}\right)^{\frac{1}{4}}+\left(\frac{1-a}{1+a}\right)^{\frac{1}{2}}=0.$$

$$\therefore \left[\left(\frac{1+x}{1-x}\right)^{\frac{1}{4}}-\left(\frac{1-a}{1+a}\right)\right]^2=0. \quad \therefore \frac{1+x}{1-x}=\frac{1-a}{1+a}.$$

$\therefore x=-a.$

(2). $\sqrt{(a^2-x^2)}=a^2\sqrt{(1-x^2)}-x\sqrt{(a^2-1)}.$

$$a^2-x^2=a^4-a^4x^2-2a^2x\sqrt{[(1-x^2)(a^2-1)]}+a^2x^2-x^2.$$

$\therefore 2a^2x\sqrt{[(1-x^2)(a^2-1)]}=a^2(1-x^2)(a^2-1).$

$\therefore \{2x-\sqrt{[(1-x^2)(a^2-1)]}\}\sqrt{[(1-x^2)(a^2-1)]}=0.$

$\therefore 4x^2=(1-x^2)(a^2-1)$ or $x^2=1.$

$\therefore x=-1, +1, \text{ or } \pm\sqrt{\frac{a^2-1}{3+a^2}}.$

The values $x=-1$ and $\sqrt{\frac{a^2-1}{3+a^2}}$ are the values satisfying the equation as given.

124. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

A certain quantity of alcohol diluted with water so that in one liter there are c liters of pure alcohol, is mixed n times successively with p times the quantity of alcohol diluted so that 1 liter contains a liter of pure alcohol. How much pure alcohol does one liter of the nth mixture contain ?